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Quantitative Vegetation Inventory

Value-added baseline inventory and monitoring

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Vegetation Sampling

- Assess existing data
- Assess resources available for the project
- Be explicit about what you wish to learn from the data you collect: write objectives
- Enlist the help of an experienced statistician
- Determine sampling framework, sample units, and measurements

Existing data

- Does the park have a vegetation map?
- If so, is it digitized?
- Is it old? All the better!
- Is there a recent species list for the park?
- Is there a list of exotic species?
  - A random sample will not find all species, so use this list to search out the remainder.

Available resources

- How much time per year?
  - Can the survey be completed in a single year?
- How many years?
- How many people?
- Include costs of preparation
- Include costs of data entry and analysis

Consider your objectives

- Do you want a species list?
- Do you want to track changes over time (what time step)?
- Do you want to draw broader, statistically-based inferences from the data?
- Do you want to evaluate management actions?

Statistical Support

- Involve the statistician in the planning stages.
- Write out the statistical model so you know you have enough degrees of freedom for the tests that are important to you.

Sampling Framework

- Is the landscape structured in some way, such as by vegetation or soil type?
- How is the vegetation itself structured?
  - Which layers are important?
- Are there management action that require evaluation (current or planned)?
- What is the temporal scale of the study?
  - Multiple years?
    - Consider how to separate year and climate effects
  - Multiple seasons?
    - Remember that plants grow at different rates – think carefully about cover/biomass comparisons

An example from the northern mixed-grass prairie

Acknowledgements

- Patrick Anderson – crew leader, field botanist
- Wes Newton – statistician
- Steve Hager – GIS specialist, TRNP
- Sara Marks – technician, field botanist
- Amy Beaulieu – technician, field botanist
- Meghan Dinkins – technician, field botanist

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Theodore Roosevelt National Park, South Unit: Vegetation Types

Veg all.shp
- Bare ground
- Big sagebrush/Blue grama
- Big sagebrush/Spiny saltbush
- Brush
- Cottonwood/Rocky Mountain juniper
- Dwarf sagebrush
- Hardwood draw
- Highway right-of-way
- Introduced grass
- Little Missouri River
- Little bluestem
- Little bluestem/Creeping juniper
- Man-managed
- Marsh
- Needle-and-thread/Blue grama
- Petrified Forest complex
- Prairie dogtown
- Quaking aspen/Mountain birch
- River bottoms
- Rocky Mountain juniper/Little-seed ricegrass
- Rolling scoria complex
- Steep scoria complex
- Western wheatgrass/Green needlegrass
- Western wheatgrass/Needle-and-thread

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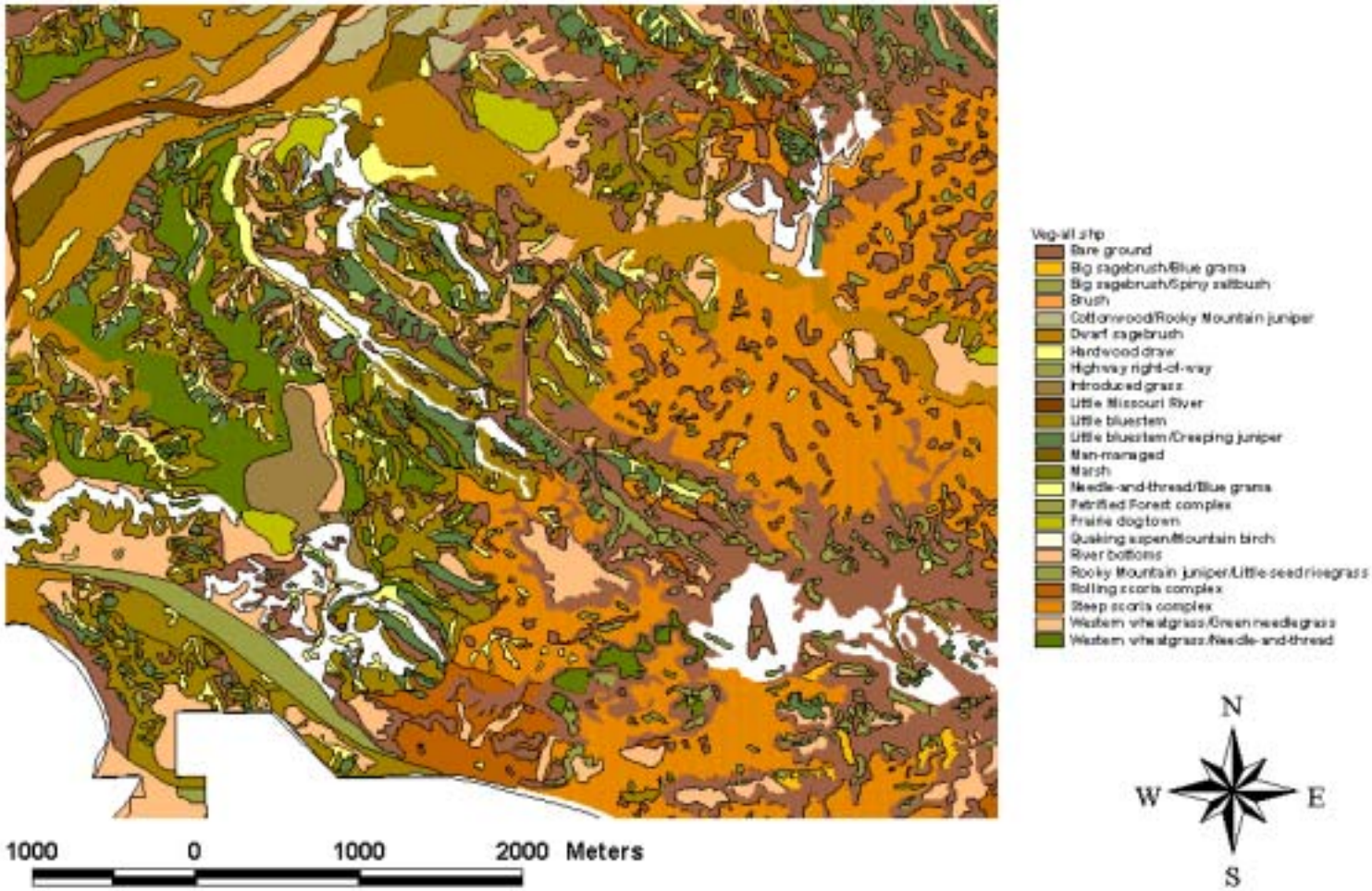
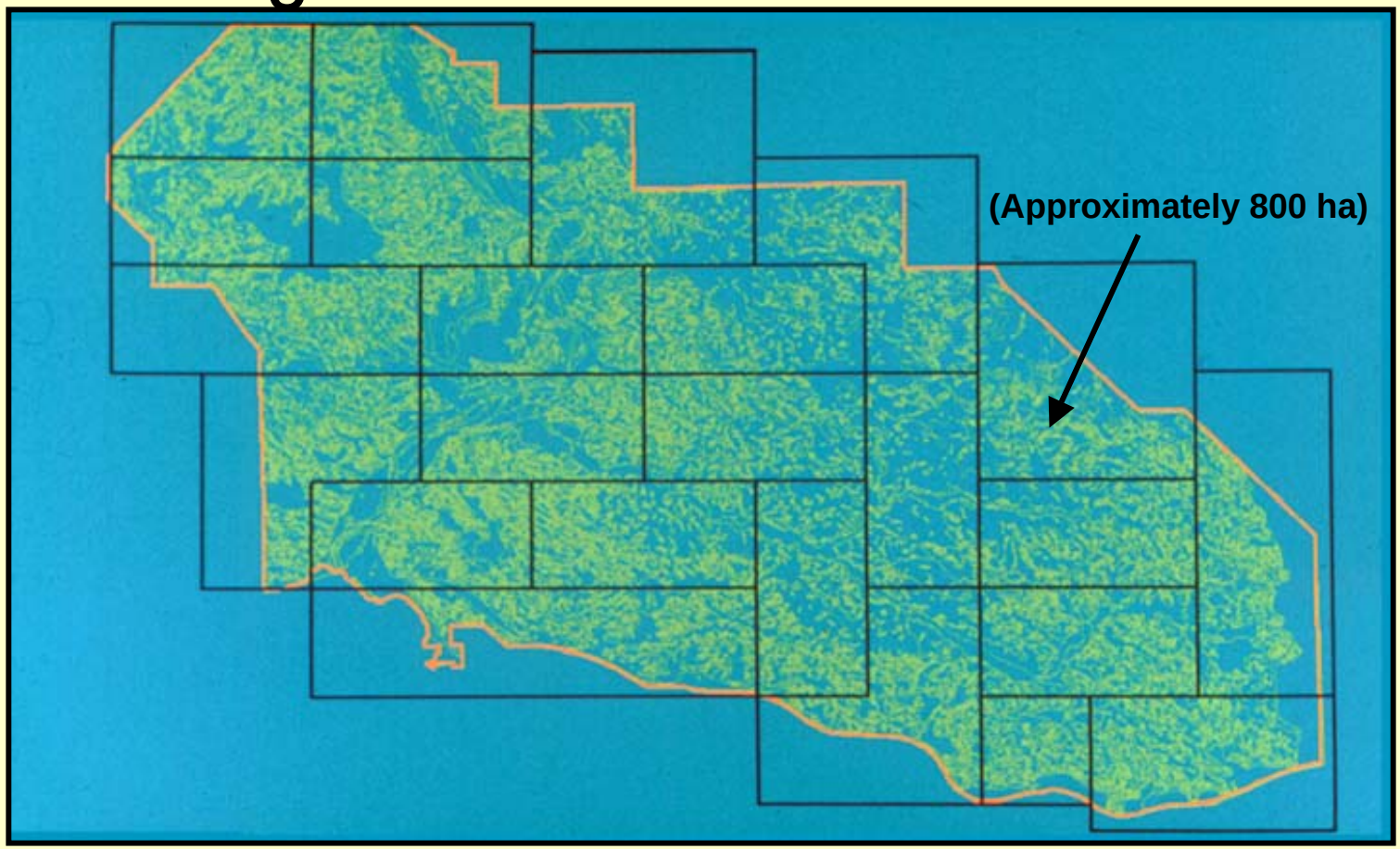
Vegetation types: detail



Stratify to ensure geographic coverage



Use GIS to delineate sampling framework

- Calculate area of each vegetation type in each stratum.
  - Sample in proportion to the area.
- Randomly select points in each vegetation type in each stratum.
  - Record the coordinates of the points so field personnel can navigate to them.
  - Transects will run from edge of vegetation type through point.

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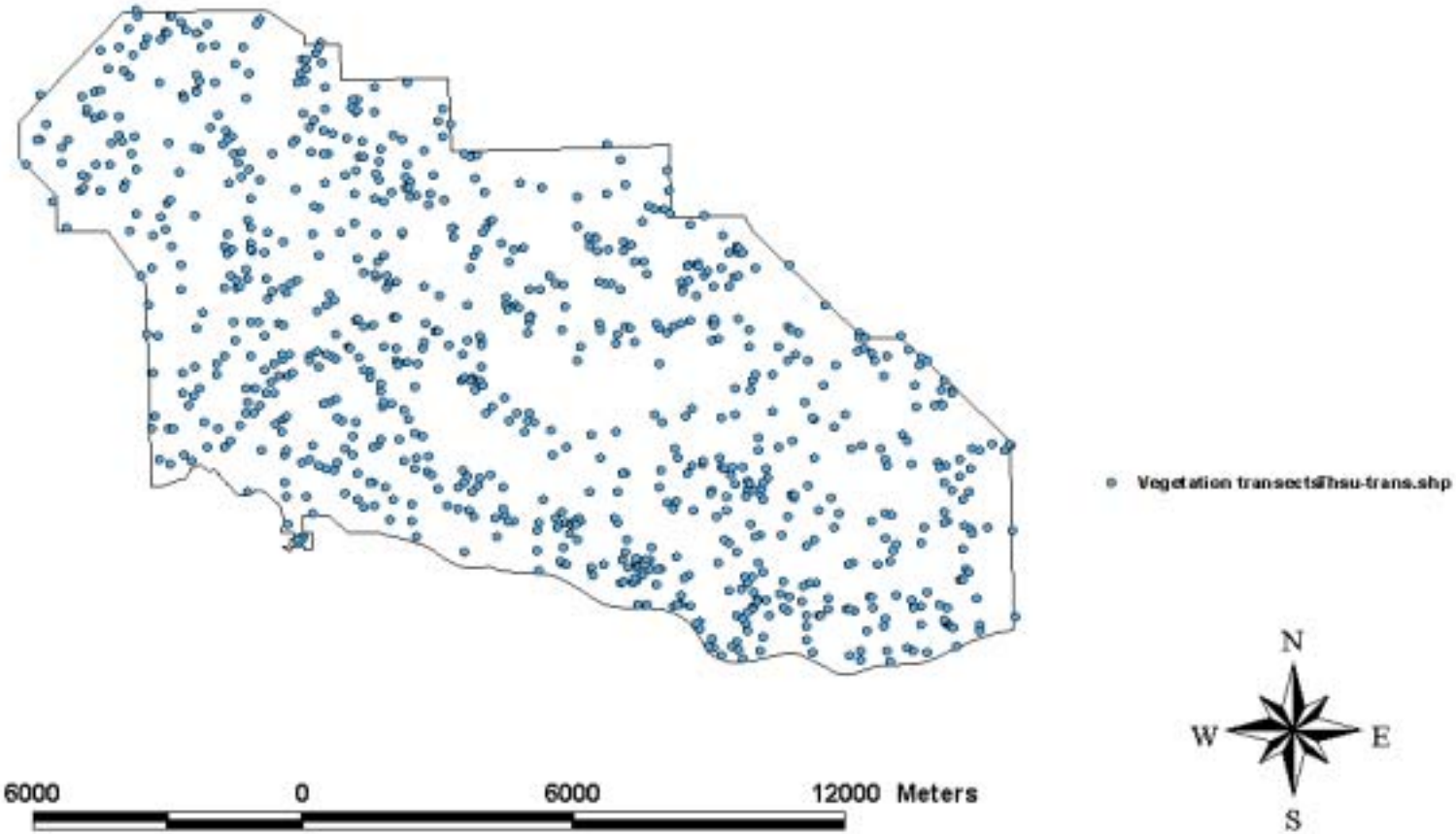
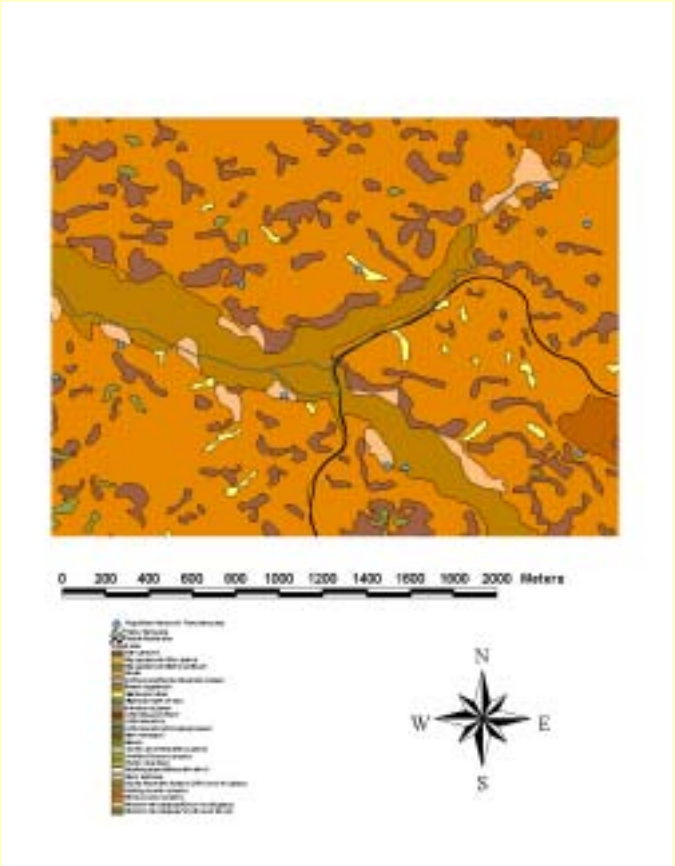
Vegetation Sample Locations



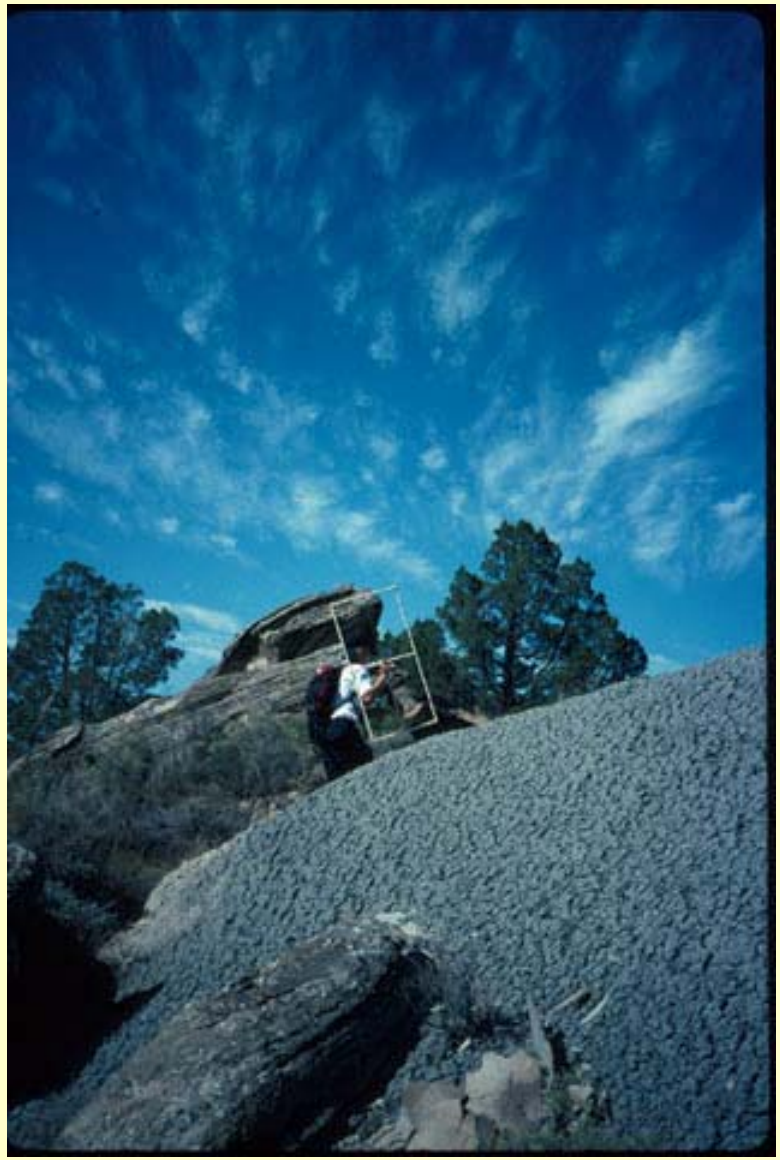
Preparation for fieldwork

- Large paper maps of each stratum, showing vegetation types, roads, trails and sample locations, were prepared.
- Sampling sequence was randomized.



Field Techniques

We navigated to the pre-determined point; the actual starting point of each transect was recorded on hand-held GPS units.



Transects were the sample unit

- Transects were oriented with the elevation gradient to capture the greatest number of species.
- Plots (0.5 x 2.0m) were oriented across the elevation gradient.
- If we could see across the vegetation type, we ran the transect from one edge to the other.
- For larger patches, we used 20 paces between plots.
- Frequency was calculated as the number of times a species occurred on a transect divided by the total number of plots on the transect.

Transects: Advantages and Disadvantages

- The main advantage is speed: Transects can be set up very quickly.
- The main disadvantage is bias: Transects will under-estimate clonal or clumped species and over-estimate more evenly distributed species.

Nested plot for grassland habitat

Subunit number	Dimensions (cm)
1	6.25 x 12.5
2	12.5 x 25.0
3	12.5 x 50.0
4	25.0 x 50.0
5	25.0 x 100.0
6	50.0 x 100.0
7	50.0 x 200.0

Nested Plots: How we used them

- Plot frame was placed on the ground across the elevation gradient.
- Subunits were searched in turn and species were recorded only once, in the smallest subunit in which they occurred.
- *All* species were recorded.

Nested Plots: Why we used them

- Field personnel could more easily search small areas for cryptic species.
- Size could be scaled back during analysis to detect differences in very abundant species.

Why did we use frequency rather than cover?

- Our field season lasted from May through September. Species grow at different rates over this period.
- Field personnel were expected to change from year to year, so that consistent cover estimates would be difficult to achieve.
- We were more concerned with the species' presence than ecological impact.

Person-power and results

- A two-person crew working May – September (one GS-7 and one GS-5)
- 847 transects with frequencies of all species
- Data entry, error checking and manipulation took approximately 2 additional months

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How can the data be used?

- Original design:
  - Distribution of exotic species across the park
  - Association between vegetation types and exotic species
  - Association among various exotic species

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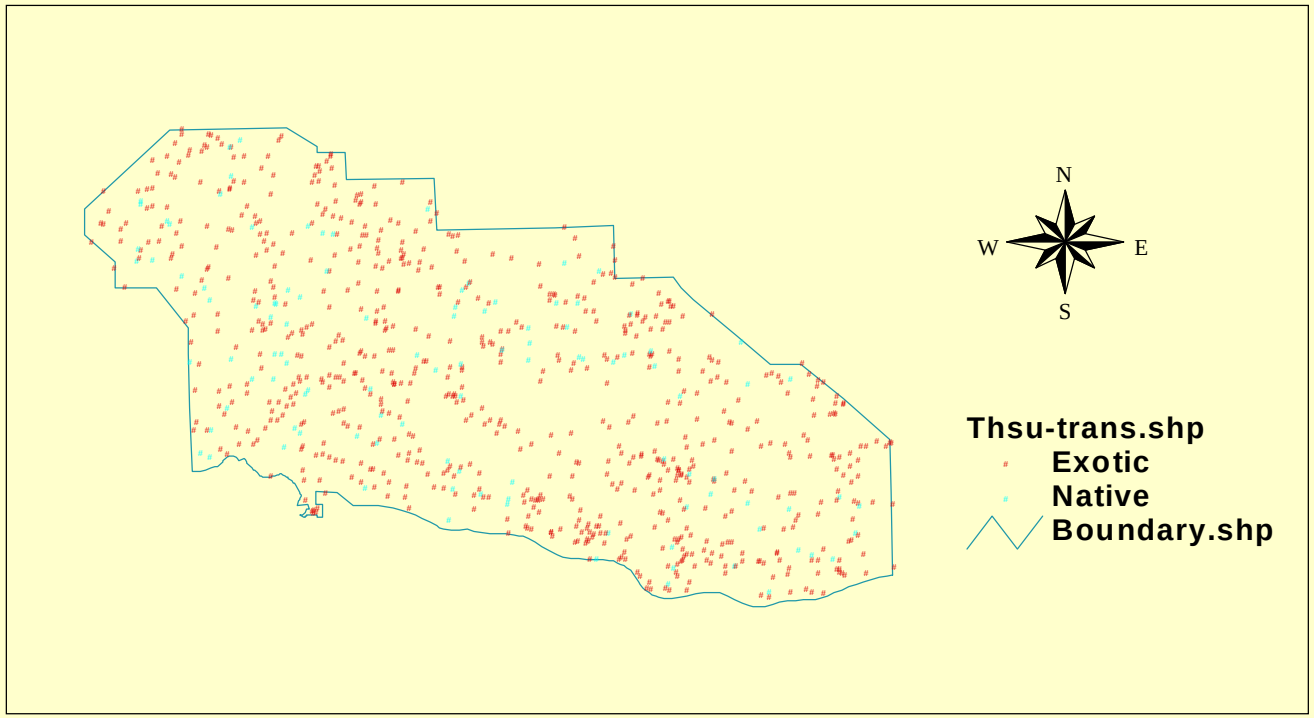
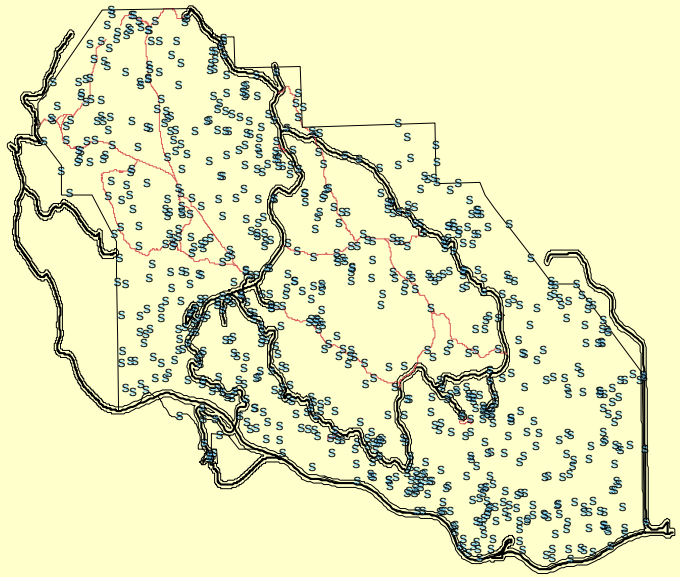
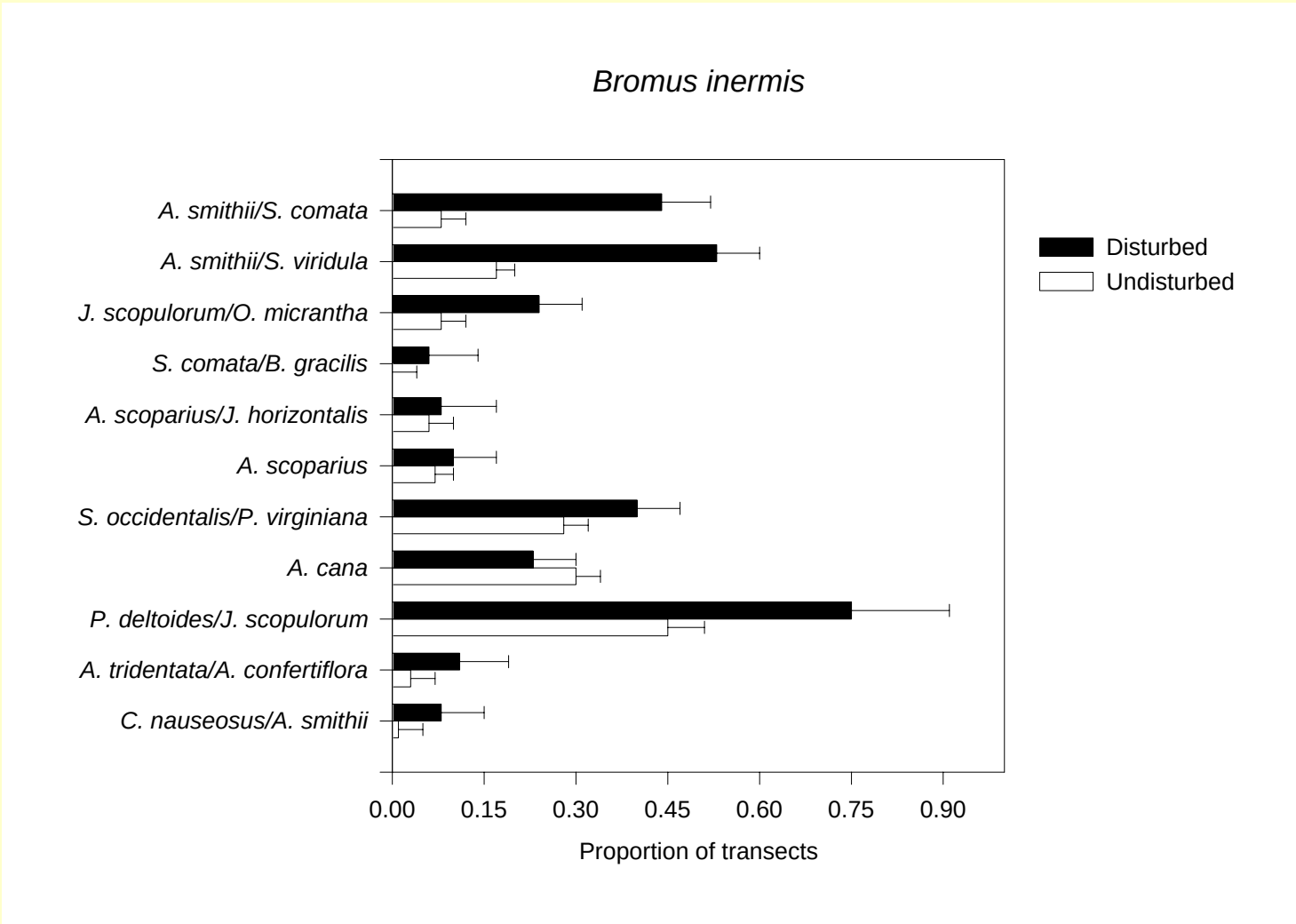
Distribution of exotic species at Theodore Roosevelt National Park, South Unit



A posteriori analyses

- Resample data based on criteria of interest
- Create buffers at various distances from disturbances, for example





Individual species can be characterized with respect to association with vegetation type, disturbance, and other variables

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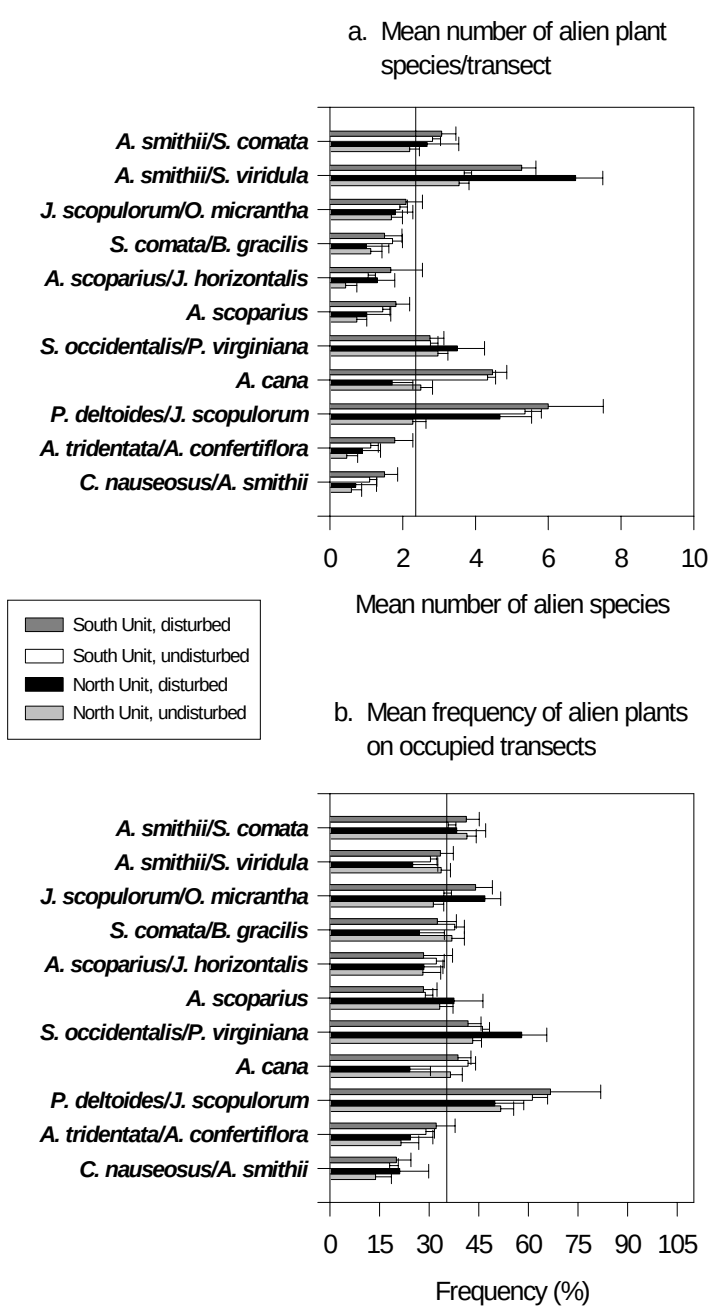
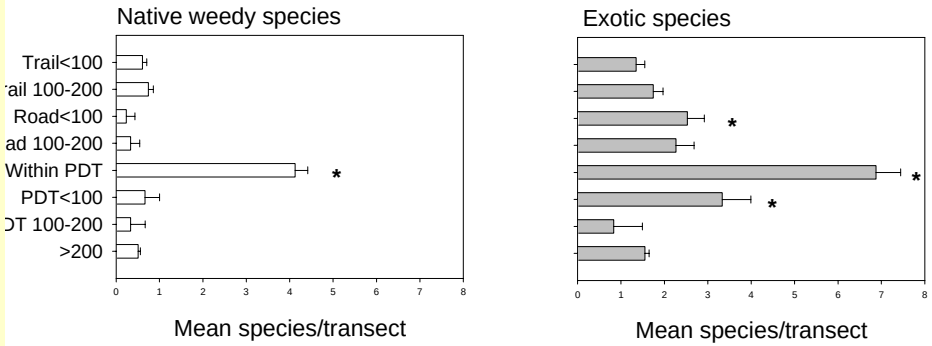
Vegetation types can be characterized in terms of number and frequency of exotic species

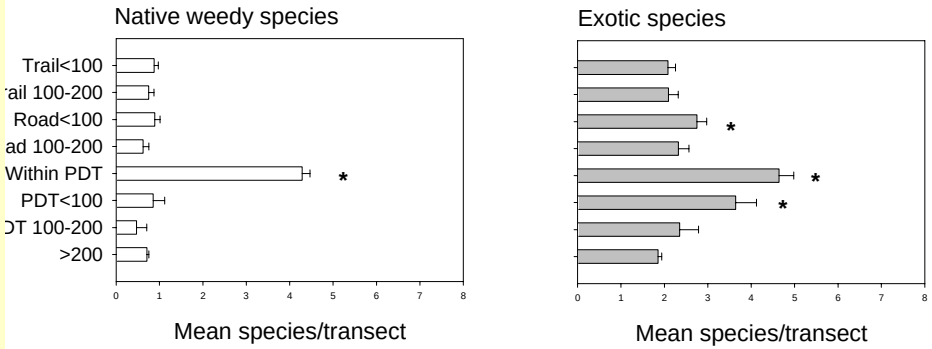


Data collected in comparable ways can be used for cross-park analyses

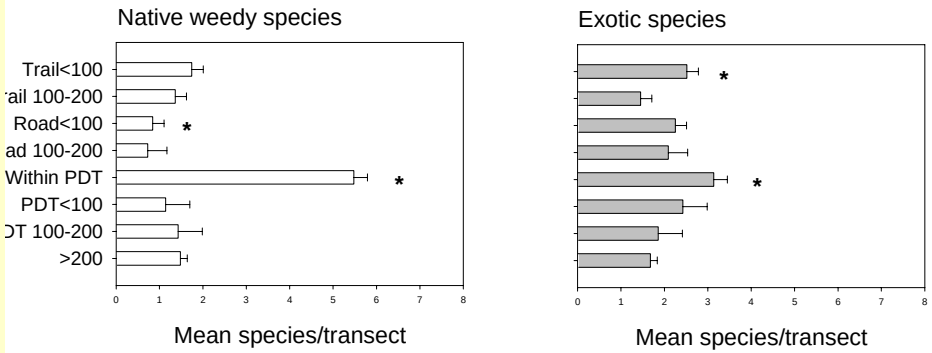
Theodore Roosevelt National Park, North Unit



Theodore Roosevelt National Park, South Unit



Wind Cave National Park



Study site selection

- Resulting data base can be used to locate areas with desired species compositions

Implications for monitoring

- Sharpen the focus of monitoring efforts
  - Increase effort in vulnerable vegetation types
- Statistically valid sampling framework for subsequent monitoring
  - Data can be used to ask additional questions
- Evaluate management actions, if any